

CLAIMS

1. A pumping system comprising: a pumping mechanism; a motor for driving the pumping mechanism; a drive control for controlling the motor; and means for monitoring at least one state within the system; wherein, to improve the performance of the system, the drive control causes the system to operate for transient periods in an overload condition which can result in said monitored state exceeding a predetermined operational limit, and when operating in said overload condition said drive control controls the power to the motor dependent on the level of said monitored state thereby avoiding said state from exceeding said operational limit.

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2. A system according to Claim 1, wherein the performance is improved by said drive control increasing the power supplied to the motor to a level which can result in said monitored state exceeding a predetermined operational limit.

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3. A system according to Claim 1 or Claim 2, wherein the drive control causes the system to operate in an overload condition when a load on the motor requires increased power supply to the motor.

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4. A system according to any preceding claim, wherein the drive control does not limit said power unless said state exceeds a predetermined lower limit.

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5. A system according to Claim 4, wherein above said predetermined lower limit, said drive control gradually reduces or increases power dependent on said monitored state.

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6. A system according to any preceding claim, wherein said drive control includes gain circuitry which can adopt: a gain of 1 thereby not limiting

motor power; a gain of zero thereby limiting motor power to zero; and any gain between one and zero, said gain circuitry controlling said gain according to a predetermined relationship with said state.

- 5 7. A system according to any preceding claim, wherein the drive control controls the power of the motor by limiting the current supplied to the motor by adjusting the frequency of the voltage and/or the amplitude of the voltage supplied to the motor.
- 10 8. A system according to Claim 7, wherein the drive control comprises programmable means for setting a maximum allowable current in said motor thereby setting the extent to which the system can be overloaded.
- 15 9. A system according to any preceding claim, wherein said state is a temperature within the system.
10. A system according to any preceding claim, wherein said state is a calculation of the thermal load of the motor or drive or any part of the pumping mechanism.
- 20 11. A system according to Claim 10, wherein the drive control estimates the motor thermal load according to:

$$25 \quad \left(\frac{I_{Motor}}{I_{Rated}} \right)^2 \times \frac{1}{1 + s\tau}$$

where:

I_{motor} is the current in the motor;

I_{rated} is a rated current above which said motor is operating in said
30 overload condition;

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τ is a time constant; and
s is the Laplace operator.

- 5 12. A system according to any of Claims 1 to 8, wherein said monitored state within the system is any one or more of: a pressure; a current; a voltage; an impedance, or a temperature.
- 10 13. A system according to any preceding claim, wherein the drive control comprises means for receiving input from one or more sensors for monitoring one or more said states within the system, and when the drive control causes the system to operate for transient periods in an overload condition the power to the motor is controlled to avoid said one or more states from exceeding the predetermined operational limit.
- 15 14. A system according to Claim 13, wherein the one or more sensors are for sensing one or more of gas pressure, temperature, voltage, or impedance within the system.
- 20 15. A system according to any preceding claim, wherein the drive control comprises a variable speed drive for controlling the power to the motor dependent on the level of said monitored state thereby avoiding said state from exceeding said operational limit.
- 25 16. A system according to any preceding claim, wherein the drive control comprises analogue means for controlling the power to the motor dependent on the level of said monitored state thereby avoiding said state from exceeding said operational limit.
- 30 17. A system according to any preceding claim, wherein the drive control is operable to prevent said system from operating in an overload condition.

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18. A system according to any preceding claim, wherein said pumping mechanism is a vacuum pumping mechanism.
- 5 19. A method of controlling a pumping system comprising: a pumping mechanism; a motor for driving the pumping mechanism; and a drive control for controlling the power to the motor, wherein said method comprises improving the performance of the system by causing the system to operate for transient periods in an overload condition which
10 can cause said monitored state to exceed a predetermined operational limit, and, when operating in said overload condition, controlling the power to the motor dependent on the level of said monitored state thereby avoiding said state from exceeding said operational limit.

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